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DO EXCHANGE RATE REGIMES MATTER?

Evidence for Developing Countries

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May 2006

Abstract

Most countries which have experienced exchange rate crises over the last two decades have been under soft pegs or crawls. These exchange rate arrangements have normally succumbed in the face of massive capital inflow reversals --especially in developing countries-- thus provoking a search for options. Hard pegs and floating regimes seem to be the only viable options.

This paper carries through an empirical analysis with panel data to study the relationship between the option of exchange rate regime and macroeconomic performance in developing countries. We use an extended and updated database to study the evidence for 154 countries over the period 1974-2004. Performance is measured by per capita GDP growth and its volatility. Our results show that floating rates tend to present higher levels of growth and lower levels of volatility in relation to other exchange rate arrangements. Intermediate regimes (soft and crawling pegs), on the other hand, score at the bottom of the growth rankings, while hard pegs appear to induce the largest growth volatility.

In light of these results, it should not come as a surprise that the world is not moving to a single global currency, as some have predicted. The world is moving to fewer currencies, but at an extremely slow pace. Yet, floating rates will probably remain the most popular form of exchange rate regime over the next half century. This paper provides some basis for that popularity.

Key words: exchange rate regimes, hard pegs, developing countries, growth regressions, volatility.

JEL classification: C13, C23, F31, O40, O47.

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1. Introduction

Until recently, little importance was given to the exchange rate regime as a determinant of macroeconomic performance. This situation has changed following the Asian crises of 1997-98 and its repercussions in Russia and Latin America. Almost all the countries that fell into crises had managed pegs (i.e., Thailand, Indonesia and South Korea; then Russia, Brazil and Ecuador). The pressure caused by massive capital inflow reversal and weakened domestic financial markets caused the collapse of exchange rate regimes, even in those countries following sound macroeconomic policies.

The failure of soft pegs has provoked a search for options, especially in developing countries where hard pegs and flexible regimes appear as the only options. However, economic theory does not provide clear results in order to assess and use this emerging consensus as a useful framework for economic policy. Hence, the problem is in the end empirical in nature.

This paper carries through an empirical analysis to study the relationship between the exchange rate regime and macroeconomic performance in developing countries. Performance is measured by two variables: per capita GDP growth and the volatility of per capita GDP growth. Our analysis uses a *de-facto* classification and not the IMF *de-jure* classification utilized by most papers in this area. We use an extended sample of countries up to the year 2004, thus considering the numerous collapses and regime changes occurred in the second half of the 1990s. The results showed in this paper give empirical support to the preference for flexible regimes raised, among others, by Larraín and Velasco (2001, 2002).

The paper is organized as follows: section 2 describes the recent evolution of exchange rate regimes through the world, including dollarization and currency boards; then, section 3 reviews the main theoretical arguments for the election of an exchange rate regime. The next section discusses the specific empirical literature linked to our paper; section 5 describes the data and our empirical

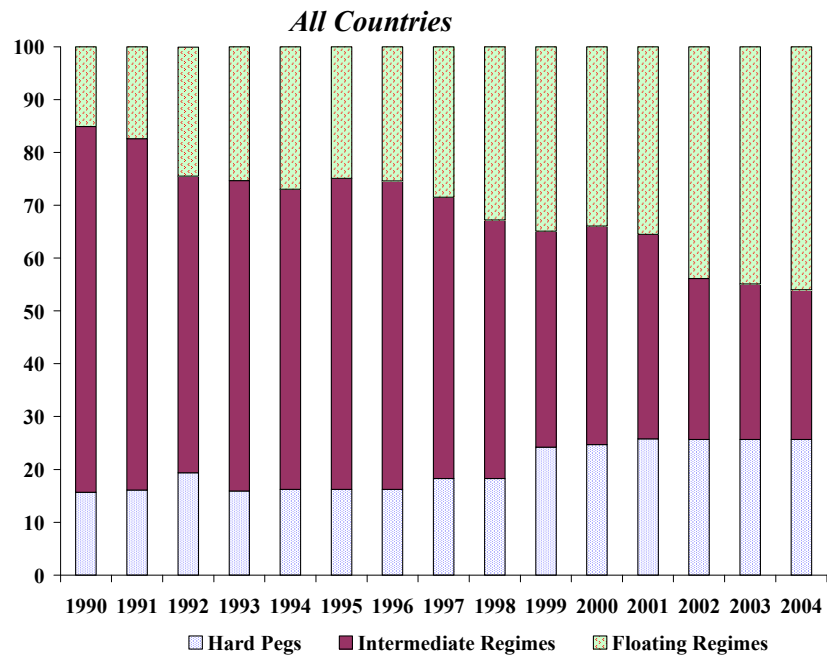
approach; section 6 shows a preliminary empirical analysis, whereas section 7 shows and analyzes our results. Finally, section 8 concludes.

2. Recent evolution of exchange rates regimes

Figures 1 and 2 describe the evolution of exchange rate regimes based on the classification of the International Monetary Fund (2002, 2004) for the period 1990-2004. Figure 1 plots the whole sample of countries, and clearly shows that the proportion of countries with intermediate regimes has diminished through time while extreme arrangements have become more popular. However, the exchange rate option has not been indifferent between the extremes: floats have gained more ground than hard pegs.

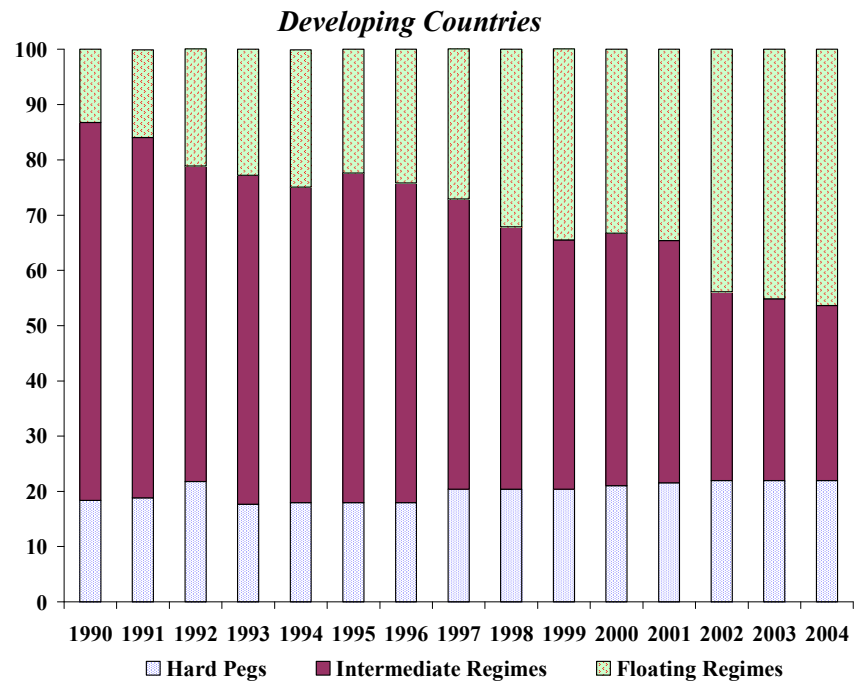
This trend is even more evident for developing countries, as shown in Figure 2. Intermediate exchange rate regimes have diminished from 68.4% of the total countries considered in 1990 to 31.7% in 2004, whereas flexible arrangements have increased from 13.2% in 1990 to 46.3% in 2004. Hard pegs have experienced a much slower increase, going from 18.4% in 1990 to 22.0% in 2004. The difference between the total sample and developing countries with respect to hard pegs is explained by the adoption of the Euro in 11 developed countries in 1999.

Figure 1. Exchange Rate Regimes, 1990-2004



Source: IMF (2002, 2004).

Figure 2. Exchange Rate Regimes, 1990-2004



Source: IMF (2002, 2004)

Among hard pegs, the most radical alternative is to adopt the currency of another country as legal tender. The most common case is dollarization --when the U.S. dollar is used. This is the only type of hard peg arrangement existing in Latin America since the Argentinean currency board died in December 2001. Table 1 describes some officially dollarized countries by the end of 2004. Interestingly, the only dollarized economies of certain size are in Latin America. Outside this region the dollarized countries are very small: none with more than 130,000 inhabitants. Another interesting aspect is that Latin America has both the oldest dollarization --Panama--, which has lasted a century using the U.S. dollar as legal tender, and the most recent ones --Ecuador (2000) and El Salvador (2001). It is worth noticing that Ecuador dollarized when the country was experiencing an economic and political crisis, which finally caused the collapse of the government.

Dollarization can be an attractive choice for small countries, with flexible prices, bad experience in the use of the monetary policy, high levels of trade of goods and capital flows with the U. S., and highly correlated shocks with those affecting the U. S. These countries can reduce inflation to levels similar to those of the country whose currency they adopt, benefit from lower interest rates and a lower exchange rate risk. However, these potential benefits are achieved at the cost of a loss of both seigniorage revenue and the ability to use monetary policy as an instrument to offset the impact of aggregate shocks. Additionally, the ability of the central bank to act as lender of last resort in the face of system-wide liquidity crunches is severely reduced.

Table 1. Dollarized Countries, 2004²

Country	Beginning	Population (Mill.)	GDP (US\$ mill.)	GDP per capita PPP (US\$)	Trade with USA (%)
<i>America</i>					
Ecuador	2000	13.213	30281	3885	29.7
El Salvador	2001	6.658	15824	5166	30.9
Panama	1904	3.028	13793	7344	38.5
<i>Outside America</i>					
Marshall Islands	1944	0.060	108	1600	n/a
Micronesia	1944	0.127	226	2000	n/a
Palau	1944	0.020	127	9000	n/a

Source : World Bank (2005).

Other type of hard peg, less rigid than dollarization, is the currency board. In this kind of arrangement the monetary authority fixes its exchange rate by means of an institutional commitment, and changes its money base in strict relation to the change in foreign exchange reserves. Nowadays no country in Latin America has a currency board (after the collapse of Argentina's board in December 2001) although it exists in other latitudes, as Table 2 shows.

Table 2. Countries with Currency Board, 2004³

Country	Beginning	Population (Mill.)	GDP (US\$ mill.)	GDP per capita PPP (US\$)
Bosnia and Herzegovina	1997	3.836	8121	7100
Brunei Darussalam	1967	0.361	4800	24826
Bulgaria	1997	7.780	24131	8007
Estonia	1992	1.345	10808	13801
Hong-Kong	1983	6.845	163005	30779
Lithuania	1994	3.439	22263	13021

Source : World Bank (2005).

In spite of some influential predictions and powerful advocates, the world does not appear to be moving to a single global currency. In a well-known piece, Cooper (1984) endorsed the idea and predicted that it would happen by 2009. More recently, other authors have argued in favor of just a few currencies for the world;⁴ probably the most influential advocate of this view is Robert Mundell. Nonetheless, though the number of independent currencies has declined over the last 3 decades, the pace has been extremely slow. In 1974 we counted 169 independent currencies among the countries covered by the International Monetary Fund; in 2004 the number was down to 149, mainly influenced by the adoptions of the Euro by 12 European countries, and of the Eastern Caribbean Currency Unit (ECCU) by a group of 6 Caribbean countries. Thus, the world is moving

² This selection of countries includes only those that adopted the U.S. dollar as legal tender.

³ Djibouti was excluded because of data availability.

⁴ Haussman (1999), suggestively titled his paper "Should there be five currencies or one hundred and five?"; in the same issue, Larrain and Sachs (1999) argued the case for flating.

to fewer currencies, but at an extremely slow pace. Cooper's prediction will not happen in 2009 or anytime in the foreseeable future. More countries are likely to adopt the Euro over the next decade, and a few others may dollarize. Yet, we see no reason for the popularity of floating rates to wane. On the contrary, floating rates will probably remain the most popular form of exchange rate regime. This paper provides some basis for that popularity.

3. Theoretical arguments in the election of exchange rate regime

The theoretical literature usually stresses a trade-off between credibility and flexibility in the exchange rate option. The best known statement favoring floating rates is based on Friedman (1953) and relates to the ability of a flexible exchange rate to absorb real shocks faced by the economy. Friedman argued that in the presence of short-term rigidities (for instance, as a result of non-flexible labor markets), real exchange rate adjustments necessarily follow movements in nominal exchange rates and, thus, a flexible regime could be better.

Under a fixed exchange rate regime, the adjustment towards a new equilibrium takes the time domestic prices use in adjusting; this process may be slow and painful when rigidities exist in the markets, especially when it is required that prices fall. The consequences of this are reflected in price distortions, inefficient allocation of resources, high and persistent unemployment, lower growth and higher growth volatility. On the other hand, a flexible exchange rate regime allows faster adjustments in the real exchange rate, avoiding the above mentioned problems. Therefore, the flexibility argument is especially strong if the country in question is frequently buffeted by large and volatile real shocks from abroad. Foreign real variability, moreover, is likely to be large for exporters of primary products and for countries that have a large foreign debt, a profile that fits many developing countries. Indeed, the 1990s and early 2000s have so far produced large fluctuations in the terms of trade and international interest rates relevant for such countries.

The main argument favoring hard pegs (in terms of better macroeconomic outcomes) claims that local monetary authorities experience higher levels of credibility, given their resignation to manage local monetary policy under a world with high capital mobility. Thus, the economy would avoid opportunistic and political-cycle maneuvers in monetary policy. However, this argument is not always valid, since escape clauses exist and are known to the public. Economies with high rigidities or experiencing severe adverse shocks may leave a hard peg in order to recover macroeconomic equilibrium faster. Hence, discipline of the monetary authorities under a hard peg is not entirely credible; this credibility depends on the trade-off between short-term costs of maintaining the regime and defending the currency versus the long-term benefits of the system.

Public skepticism on the sustainability of a hard peg is frequently reflected in high spreads between local currency denominated bonds and foreign currency denominated ones. That was the case in Argentina; although managing a currency board - ARG\$1 equaling US\$1- experienced high interest rate spreads between bonds denominated in Argentinean pesos and bonds in US dollars. This reflected the market expectations on a probable devaluation of the local currency jointly with the low credibility of the system. Even if the system may have been totally credible, there still exists default risks under hard pegs, which are also incorporated in bonds spreads. Additionally, as pointed by Obstfeld (1997), this kind of situations often allows multiple equilibria and self-fulfilling crises.

A second argument linking better economic outcomes with fixed exchange rate regimes relates to better fiscal discipline in countries managing hard pegs. Countries with fixed regimes must be especially cautious with their fiscal balances, since (over) expansionary spending can easily lead to a balance of payment crisis, as indicated by Krugman (1979). Knowing this fact, governments using hard pegs would be extremely cautious with their overall fiscal balances. However, as indicated by Tornell and Velasco (2000) flexible exchange rate regimes also face these kind of problems; excessive public spending always has negative outcomes. The difference between

the two exchange rate arrangements is the intertemporal distribution of costs. Under a fixed regime the costs are delayed until international reserves start to deplete; under a float the costs manifest themselves immediately through nominal exchange rate depreciation and inflation.

On the whole, the link between exchange rate regimes and welfare depends on the characteristics of the country in question, which determine if credibility or flexibility becomes more necessary. Some important factors to consider are the degree of labor market flexibility, openness of the economy and capital mobility, correlation of shocks, currency mismatch between assets and liabilities, financial development, credibility of policymakers and concentration of output, exports and portfolios.

4. Empirical literature

Empirical papers studying the relationship between exchange rate regime choice and macroeconomic performance are rather scarce in the literature, though they have increased in recent years. Ghosh et. al. (1997) analyze the link between exchange regime options and macroeconomic performance studying data for 140 countries in a 30 year sample; their results suggest that growth varies only slightly across regimes.

Hausmann et. al. (1999) state that flexible exchange regimes in Latin America have not been related to higher levels of monetary autonomy nor have they successfully worked as a “buffer” of external shocks. On the contrary, they argue that free floats have promoted wage indexation and pro-cyclical monetary policy responses. They conclude that hard pegs can solve credibility issues that are common in Latin American Experience.

Levy-Yeyati and Sturzenegger (2003) study 154 countries between the years 1974 and 2000. Using a *de facto* classification, they find that more flexibility is strongly linked to higher growth rates and lower volatility of output for non-industrial countries. This link appears to be

much weaker for industrial economies. However, they do not find significant statistical differences in macroeconomic outcomes between intermediate and fixed regimes for non-industrial countries.

On the other hand, Calvo and Mishkin (2003) conclude that the choice of exchange rate regime is likely to be of second order importance in the macroeconomic success of emerging economies. Their analysis suggests that less attention should be focused on the general question of whether a floating or a fixed exchange rate is preferable, and more on institutional reforms, which may encourage emerging market countries to be healthier and less prone to the crises that we have seen in recent years.

Edwards and Levi-Yeyati (2003) analyze empirically the effect of terms of trade shocks on economic performance under alternative exchange rate regimes. Their results suggest that terms of trade shocks get amplified in countries that have more rigid exchange rate regimes. They also find evidence supporting the view that, after controlling for other factors, countries with more flexible exchange rate regimes tend to grow faster than countries with fixed exchange rates.

Reinhart and Rogoff (2004) use monthly data for a sample of 153 countries and classify the different exchange systems taking in consideration the parallel market exchange rates. Their evidence suggests that exchange rate arrangements may be quite important for growth, trade and inflation.

Husain, Mody and Rogoff (2004) find that countries appear to benefit by having increasingly flexible exchange rate systems as they become richer and more financially developed. According to their results, pegs are notable for their durability and relatively low inflation in developing countries with little exposure to international capital markets. For emerging markets, their results show that the exchange regime does not appear to have a systematic effect on growth.

More recently, Larraín (2005) analyzes the experience of 147 countries between the years 1974 and 2000. He concludes that countries with flexible regimes are linked with higher levels of growth and lower levels of volatility in relation to other possible exchange rate arrangements.

The brief literature review in this section and the previous one indicates that as a result of the trade-off between flexibility and credibility, theoretical developments cannot provide us with answers on which exchange regime option is more strongly related to better macroeconomic outcomes. Additionally, the empirical evidence is not conclusive and most of the previous studies work with data until the year 2000. Nevertheless, we could venture to suggest that the most recent works that use a *de-facto* classification tend to corroborate the superiority of floating regimes over hard pegs and intermediate regimes. We now present some additional evidence on this debate using an extended sample of countries up to the year 2004.

5. Data description and methodology

This paper uses panel data from 154 developing countries in a thirty-year sample ranging from 1974 to 2004.⁵ Data was collected from the World Bank's Global Development Indicators⁶.

Most cross-country studies on exchange rate regimes use the official *de jure* regime classification reported annually by the International Monetary Fund (IMF). Such classification has the problem that countries frequently do not manage their currencies as they claim to. For example, countries claiming to run a free float may be intervening heavily in the exchange rate spot market in order to avoid unwanted nominal volatility; in a *de facto* classification, such countries would have an intermediate/fixed regime and not a flexible one. Analogously, if the authorities devalue frequently in order to accommodate monetary policy in self-proclaimed hard pegs, such schemes should be classified as floats.

⁵ The list of countries used in this study is presented in Table A.1 (appendix).

⁶ All data is available on-line at <http://sima-ext.worldbank.org/query>.

To avoid these problems, we use the *de facto* classification of Levy-Yeyati and Sturzenegger (2005), which defines exchange regimes according to the behavior of the following three variables:

- Exchange rate volatility (σ_e), measured as the average of the absolute monthly percentage changes in the nominal exchange rate relative to the relevant anchor currency (or basket of currencies, whenever the currency weights are disclosed) over the year.
- Volatility of exchange rate changes ($\sigma_{\Delta e}$), computed as the standard deviation of the monthly percentage changes in the exchange rate
- Volatility of reserves (σ_r), measured as the average of the monthly changes in dollar-denominated international reserves relative to the dollar value of the monetary base in the previous month.

Flexible regimes are associated with mild interventions in the exchange rate spot market, so they should present high exchange rate volatility and high volatility of the changes in the exchange rate, joint with low volatility of international reserves. On the contrary, hard pegs are related to low levels of exchange rate volatility and low volatility of exchange rate changes, but a much higher volatility in reserves, given the need of local authorities to intervene in exchange rate markets to defend the nominal exchange rate at the established level. Finally, intermediate systems should experience moderate levels in all three variables, which would reflect movements in the nominal exchange rate alongside soft interventions. The last classification according to this methodology is that of “inconclusive”: countries showing very low variability along the three variables mentioned.

For fixed exchange regimes, the reference currency is the legal peg currency. For the rest of the countries, Levy-Yeyati and Sturzenegger use the currency against which the country's

exchange rate exhibit the lowest volatility.⁷ Countries that peg their currency to a basket are eliminated from the sample unless the central peg parity or the basket weights were known. This methodology allows to discriminate the intensity of the shocks to which the regime is subject. Table 3 summarizes the criteria used to classify the observations.

Table 3. De facto classification criteria

Regime	σ_e	$\sigma_{\Delta e}$	σ_r
Flexible	High	High	Low
Intermediate	Medium	Medium	Medium
Fixed	Low	Low	High
Inconclusive	Low	Low	Low

Source: Levi-Yeyati and Sturzenegger (2005).

6. Preliminary empirical analysis

Before undertaking the formal analysis, it is useful to do a brief preliminary empirical inspection, whose results are summarized in table 4. The average annual growth of per capita GDP in the whole sample of countries was 1.31% for the period 1974-2004. Countries with flexible arrangements had an average annual growth of 2.24%, those with hard pegs of 1.51%, whereas in countries with intermediate arrangements the average annual growth of per capita GDP was only 1.24%.

When we repeat the previous exercise for the volatility of per capita GDP growth (measured as the standard deviation of the growth rate), we obtain that the average annual volatility for the 154 countries in study was 4.37%. The lowest levels of output volatility were showed by countries

⁷ For this exercise the authors consider the US dollar, the French franc, the German marc, the British pound, the SDR, the ECU, and the Japanese yen. For some small countries, the currency of a large neighbour is also considered.

with flexible regimes (3.43%), followed by the economies with intermediate arrangements (3.76%). The highest volatility is experienced by countries with hard pegs (4.77%).

We can make a similar analysis using the median instead of the mean, because the former variable is less sensitive to extreme values (for instance, due to wars, conflicts or transition to market economies). The magnitude of the results changes, but not the qualitative conclusions. According to this analysis, flexible regimes experience the greatest median annual growth of per capita GDP (2.40%), followed by hard peg arrangements (1.75%), then by intermediate regimes (1.69%). In addition, flexible regimes show the lowest volatility of per capita GDP growth (2.59%), that is, 0.42% less than intermediate regimes and 1.01% less than hard pegs.

It could be argued, for example, that the concentration of floating rate regimes took place in periods when output growth was high. In order to control for temporary effects, we compute the average growth rate of per capita GDP in deviations from the annual average for all countries. As in the previous case, the conclusions do not change. On average, flexible regimes experience the highest per capita GDP growth rate and the lowest levels of volatility. On the other hand, intermediate regimes underperform the other schemes in terms of growth, while hard pegs seem to induce the highest levels of growth volatility.

Table 4. Preliminary Empirical Analysis

		Flexible	Intermediate	Fixed
ΔY_{pc}	Mean	2.24%	1.24%	1.51%
	Median	2.40%	1.69%	1.75%
	Controlling by temporary effects	0.64%	-0.09%	0.12%
σY_{pc}	Mean	3.43%	3.76%	4.77%
	Median	2.59%	3.01%	3.60%

This preliminary empirical analysis suggests, at first sight, that countries with floating rate systems experience the best macroeconomic performance during the period analyzed; this is reflected in both higher per capita GDP growth and lower growth volatility than the other arrangements. Floating rate countries show higher average growth than those with hard pegs, while intermediate arrangements always underperform the others.

These results suggest a correlation between macroeconomic performance and the choice of exchange rate regime, but they do not guarantee causality. In order to verify the existence of causality it is necessary to make a formal econometric analysis.

7. Econometric Estimates and Results

In order to formally study the relationship between exchange regime choice and macroeconomic performance, we perform two set of regressions using a panel data set of 154 countries for the period 1974-2004. In the first set of regressions the dependent variable is the annual growth rate of per capita GDP; in the second set the dependent variable is the volatility of per capita GDP growth rate (measured by its standard deviation). Econometric estimates are carried out using Zellner's seemingly unrelated regressions (SUR) approach.

First, regressions are ran between per capita GDP growth as a dependent variable and several control variables, including dummies for the exchange rate regime. In doing so, we try to assess the relative importance (statistical significance and sign of the coefficients) of the different regime options, once controlling for specific factors common to most growth regressions. We specify our econometric model to include both state and control variables, which, according to theory, determine the level of output per capita in the long run and subsequently the rates of growth of the economy. The first regression is of the following form:

$$\dot{Y}_{i,t} = \alpha_0 + \alpha_1 X_{i,t} + \alpha_2 D_{i,t}^{Flexible} + \alpha_3 D_{i,t}^{Intermediate} + \varepsilon_{i,t} \quad (1)$$

$Y_{i,t}$ is per capita GDP of country i in year t (a dot above a variable means percentage change). α_0 represents six regional dummies, which capture systematic growth differences between regions due to non-observable characteristics (statistically, this means that we allow for shifting intercept coefficients across regions). X is the set of explanatory variables. Following the standard literature, X includes initial conditions and policy variables. Among the initial conditions we include: the log of average per capita GDP in the period 1970-1973 (to test conditional convergence) and the log of average years of schooling in the period 1970-1975 (as a proxy of the initial level of human capital). Control or policy variables include: openness (measured as exports plus imports over GDP); government consumption as a share of GDP (lagged one period to avoid possible endogeneity problems); gross capital formation as a percentage of GDP; terms of trade changes; and financial development, measured as the difference between quasi-money and money as a share of GDP. $\varepsilon_{i,t}$ is a random term.

Additionally, we include in our baseline specification dummy variables for flexible and intermediate exchange rate regimes ($D_{i,t}^{Flexible}$ and $D_{i,t}^{Intermediate}$), according to the *de-facto* classification explained above. These variables take the value of one if the country is running a flexible or an intermediate regime, respectively, and zero otherwise. The dummy variable for hard pegs was excluded to avoid perfect multicollinearity. Table A.2 presents a summary of variable definitions and sources.

Given that endogeneity may be an issue in our regressions, specifically between gross fixed capital formation, trade openness, and per capita GDP growth, we used as instruments the fitted values of regressions between: (a) the gross fixed capital formation, its lagged value and lagged GDP growth; (b) trade openness and its lagged value. With respect to financial development, we

take stock of the mounting evidence of recent years showing that financial development causes growth and, therefore, use it directly as an explanatory variable.

We also perform regressions between the volatility of per capita GDP growth (measured by its standard deviation) and several control variables. The same exchange regime dummies were added in order to assess the relationship between growth volatility and regime choice. Additional variables included in the second regression are the volatility of gross capital formation and government consumption (both as a share of GDP), the volatility of terms of trade, financial development and six regional dummies. This regression is of the following form:

$$\sigma \dot{Y}_{i,t} = \beta_0 + \beta_1 Z_{i,t} + \beta_2 D_{i,t}^{Flexible} + \beta_3 D_{i,t}^{Intermediate} + \mu_{i,t} \quad (2)$$

Where, $\sigma \dot{Y}_{i,t}$ is the standard deviation of per capita GDP growth, β_0 represents the set of regional dummies, Z is the set of control variables, $D_{i,t}^{Flexible}$ and $D_{i,t}^{Intermediate}$ are dummies for the exchange rate regime and $\mu_{i,t}$ is a random term.

7.1 Exchange rate regimes and economic growth

The results that reveal the relationship between per capita GDP growth and the choice of exchange rate regime are shown in Table 5 below:

Table 5. Economic growth estimates

Sample: 1974-2004

Obs: 1763

Variable	Coefficient	Robust Std. Error
Average GDP per capita 1970-1973	-0.641***	0.033
Average schooling years 1970-1975	0.190***	0.057
Government consumption	-0.066***	0.005
Gross capital formation	0.074***	0.005
Openness	0.008***	0.001
Term of trade growth	0.007***	0.001
Financial development	0.009***	0.002
Dummy flexible regime	0.320***	0.060
Dummy intermediate regime	-0.534***	0.057
Regional dummy (Asia)	4.213***	0.210
Regional dummy (Africa)	2.673***	0.185
Regional dummy (Central America)	3.311***	0.206
Regional dummy (Latin America)	3.771***	0.215
Regional dummy (Europe)	3.435***	0.288
Regional dummy (small islands)	3.074***	0.244

* significant at 10%; ** significant at 5%; *** significant at 1%

According to our results, the investment rate, terms of trade growth, trade openness and financial development all have positive and statistically significant influences on per capita GDP growth. On the contrary, high levels of government expenditure seem to reduce economic growth. The negative coefficient associated to the initial level of per capita GDP is evidence in favor of the conditional convergence theory. These results are standard in the empirical growth literature.

The most interesting results, however, are those related to the exchange regime choice. According to these estimates, flexible exchange rate regimes present the best macroeconomic performance in terms of per capita GDP growth. Controlling for other variables, countries running a free float experience average annual growth 0.32% higher than those countries managing hard pegs. The worst outcomes are related to intermediate regimes, which on average grow 0.53% less each year than fixed regimes, and 0.85% less than floats.

Thus, there are important differences in economic outcomes stemming from different choices of exchange rate arrangements. These results are in contrast to the findings of Ghosh et al (1997), who do not find significant differences between the different exchange rate arrangements, and Hausmann et al (1999), who tend to favor the hard pegs; they also question the skepticism of Calvo and Mishkin (2003) about this debate. At the same time, our results contradict those who recognize the undesirability of intermediate regimes but are indifferent to the option between hard pegs and the floats, because the performance of the flexible arrangements is clearly superior to the those of hard pegs.

At the same time, these results give empirical support to the bipolar vision also known as the “two-corner solution” and the preference for flexible regimes raised, among others, by Larraín and Velasco (2001, 2002). The preference by flexible arrangements also receives empirical support of Levy-Yeyati and Sturzenegger (2003), Edwards and Levi-Yeyati (2003) and Larraín (2005). However, the results of our investigation differ from those of Levy-Yeyati and Sturzenegger because these authors do not find statistically significant differences in the rates of growth of the intermediate regimes and hard pegs for non-industrial countries. Our research helps explain why intermediate exchange rate regimes have lost popularity in recent years while floating rates have gained so many converts.

What is the economics behind this result? Intermediate regimes tend to become unsustainable under massive capital flows reversals. In these episodes the collapse is not instantaneous, and the authorities defend the exchange rate through higher interest rates and loss of international reserves, which weakens economic activity and –many times-- the financial system. In the end, the exchange rate depreciates anyway, but a large part of the damage is already done. Thus, for example, crawling pegs or narrow bands, included in our classification of intermediate arrangements, tend to be unsustainable.

Frankel, Schmukler and Servén (2000) provide an additional argument on why intermediate exchange regimes seem to be “vanishing” around the world. In their view, the limited verifiability (the ability to assess through public information which exchange regime the authority is actually running) of soft pegs plays a role against the credibility of the system. The idea behind this argument is that the credibility of an exchange regime choice is stronger if the public can check for themselves which regime exists through simple inspection of public information. Hence, the Central Bank’s credibility may not improve just because a certain exchange rate policy is announced. Thus, if the announced regime is a fixed peg, the market needs only to check that the stability of the exchange rate is greater than before to verify if the Central Bank is following the policy announced. If the arrangements is independently floating, the public can verify periodically if the monetary authority has taken part in the market observing the variation in the international reserves of the Central Bank. Nevertheless, intermediate regimes (exchange rate bands, crawling pegs, pegs to a basket of currencies, etc.) are not so easily verifiable as in the previous cases, reason why they are little transparent and, therefore, less credible.

This line of argumentation may explain why intermediate exchange rate systems relate to poorer economic outcomes, but it does not allow us to make assessments on which one of the extremes is better. Nevertheless, in the presence of rigidities in the markets that cause inflexibilities in the adjustment of the prices, the movements of the nominal exchange rate allow the quick adjustment of the economy towards their new equilibrium once the existing relative prices have been obsolete due to real shocks, such as fall in the terms of trade. On the other hand, developing countries are highly indebted, presents high concentration in the exportation and tend to be highly dependent of primary products exports, which does that the volatility of the real shocks to which they are exposed is particularly high. This, together with the fact that they have rigid labor markets (Heckman and Pages, 2001), makes necessary the flexibility of the nominal exchange rate to adjust the relative prices when they have been obsolete. In the end, we know that the adjustment of prices

is going to happen independent of the exchange rate arrangements. The point is that flotation allows to accelerate the adjustment and thus to reduce the transition costs towards the new equilibrium.

7.2 Exchange rate regimes and growth volatility

Using an analogous methodology, we now investigate the relationship between the option of exchange rate regime and the volatility of per capita GDP growth.

The results in Table 6 show that growth volatility is higher in countries with higher volatility of investment, government expenditure and terms of trade, and a less developed financial system. In contrast, higher levels of trade openness are related to lower volatility of per capita GDP growth. This point deserves to be emphasized, as it suggests there is no trade-off: deepening trade integration into the world economy not only allows to grow more but also to reduce the growth volatility.

Table 6. Growth volatility estimates

Sample: 1974-2004

Obs: 2101

Variable	Coefficient	Robust Std. Error
Volatility of gross capital formation	0.391***	0.003
Volatility of government consumption	0.267***	0.007
Volatility of terms of trade	0.022***	0.001
Openness	-0.008***	0.000
Financial development	-0.005***	0.001
Dummy flexible regime	-0.253***	0.016
Dummy intermediate regime	-0.106***	0.015
Regional dummy (Asia)	2.370***	0.027
Regional dummy (Africa)	2.676***	0.027
Regional dummy (Central America)	1.983***	0.028
Regional dummy (Latin America)	2.389***	0.032
Regional dummy (Europe)	3.051***	0.028
Regional dummy (small islands)	1.831***	0.035

* significant at 10%; ** significant at 5%; *** significant at 1%

Our results show that growth volatility is also significantly affected by the choice of exchange rate regime. Nevertheless, now the worst performance is not associated to intermediate regimes, but to hard pegs. The best performance, as with growth, is with floats. Flexible rates show lower growth volatility than the other regimes: 0.25% less volatility than hard pegs and 0.14% less than intermediate arrangements.

These results can be explained analogously to the previous case. In presence of rigid prices and wages (for example, as a result of labor markets rigidities), movements of the nominal exchange rate speed up the adjustment of relative prices, which reduces the volatility of output and employment. This option is lost when a country adopts a hard peg and, thus, the movements in output and employment are exacerbated. Hence, there is a negative relationship between economic growth volatility and the flexibility of the exchange rate regime.

8. Conclusions

This paper analyzed empirically the link between exchange rate regime choice and macroeconomic performance. Unlike previous works that either favor hard pegs or do not find significant differences in economic growth and its volatility across regimes, our evidence suggests that a strong relationship exists. Specifically, free floats seem to induce faster per capita GDP growth and lower levels growth volatility. Thus, there is no trade-off between growth and volatility, because the superiority of the flexible regimes occurs in both cases.

These results allows to understand the polarization arisen in the last decade in the election of exchange rate arrangements, where intermediate regimes have been increasingly abandoned, with countries migrating towards hard pegs or free floats. The superiority of floating rates over hard pegs, also displayed in our results, is consistent with the increasing penetration of floats in relation

to hard pegs, especially in developing economies. As a by-product, the prediction of some influential advocates that the world will converge to a single currency (or a handful of currencies) is far from materializing. The world will likely move to fewer currencies, mainly as a result of more European countries adopting the Euro, but the movement will probably happen at a very slow pace. The popularity of floats will likely remain in the foreseeable future.

One first explanation to the results of our investigation is the unsustainability of intermediate regimes, in which the monetary authority declares to defend a certain parity or a band. Given negative external shocks to an economy, in a world where international capital markets are highly integrated, the central bank needs to increase interest rates and loose reserves in order to maintain the parity; the costs of this policy in terms of output, employment and investment, and of possible trouble in the financial sector, could be staggering. At the end, the exchange rate regime collapses but a great part of the damage has already been done.

A flexible exchange rate regime provides a fast and efficient way to adjust relative prices under market rigidities and external shocks. This quality of free floats is of special relevance for developing countries, which tend to be heavily concentrated in commodity exports, are highly indebted and have rigid labor markets.

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Appendix

Table A.1 List of countries

<i>Afghanistan</i>	<i>Ecuador</i>	<i>Lithuania</i>	<i>Samoa</i>
<i>Albania</i>	<i>Egypt, Arab Rep.</i>	<i>Luxembourg</i>	<i>Sao Tome and Principe</i>
<i>Algeria</i>	<i>El Salvador</i>	<i>Macedonia, FYR</i>	<i>Saudi Arabia</i>
<i>Angola</i>	<i>Equatorial Guinea</i>	<i>Malawi</i>	<i>Senegal</i>
<i>Antigua and Barbuda</i>	<i>Estonia</i>	<i>Malaysia</i>	<i>Seychelles</i>
<i>Argentina</i>	<i>Ethiopia</i>	<i>Mali</i>	<i>Sierra Leone</i>
<i>Armenia</i>	<i>Fiji</i>	<i>Malta</i>	<i>Singapore</i>
<i>Aruba</i>	<i>Gabon</i>	<i>Marshall Islands</i>	<i>Slovak Republic</i>
<i>Azerbaijan</i>	<i>Gambia, The</i>	<i>Mauritania</i>	<i>Slovenia</i>
<i>Bahamas, The</i>	<i>Georgia</i>	<i>Mauritius</i>	<i>Solomon Islands</i>
<i>Bangladesh</i>	<i>Ghana</i>	<i>Mexico</i>	<i>Somalia</i>
<i>Belarus</i>	<i>Grenada</i>	<i>Micronesia, Fed. Sts.</i>	<i>South Africa</i>
<i>Belize</i>	<i>Guatemala</i>	<i>Moldova</i>	<i>Sri Lanka</i>
<i>Benin</i>	<i>Guinea</i>	<i>Mongolia</i>	<i>Sudan</i>
<i>Bhutan</i>	<i>Guinea-Bissau</i>	<i>Morocco</i>	<i>Suriname</i>
<i>Bolivia</i>	<i>Guyana</i>	<i>Mozambique</i>	<i>Swaziland</i>
<i>Bosnia and Herzegovina</i>	<i>Haiti</i>	<i>Myanmar</i>	<i>Syrian Arab Republic</i>
<i>Botswana</i>	<i>Honduras</i>	<i>Namibia</i>	<i>Tajikistan</i>
<i>Brazil</i>	<i>Hong Kong, China</i>	<i>Nepal</i>	<i>Tanzania</i>
<i>Brunei</i>	<i>Hungary</i>	<i>Netherlands Antilles</i>	<i>Thailand</i>
<i>Bulgaria</i>	<i>India</i>	<i>Nicaragua</i>	<i>Togo</i>
<i>Burkina Faso</i>	<i>Indonesia</i>	<i>Niger</i>	<i>Tonga</i>
<i>Cambodia</i>	<i>Iran, Islamic Rep.</i>	<i>Nigeria</i>	<i>Trinidad and Tobago</i>
<i>Cameroon</i>	<i>Iraq</i>	<i>Oman</i>	<i>Tunisia</i>
<i>Cape Verde</i>	<i>Israel</i>	<i>Pakistan</i>	<i>Turkey</i>
<i>Central African Republic</i>	<i>Jamaica</i>	<i>Palau</i>	<i>Turkmenistan</i>
<i>Colombia</i>	<i>Jordan</i>	<i>Panama</i>	<i>Uganda</i>
<i>Comoros</i>	<i>Kazakhstan</i>	<i>Papua New Guinea</i>	<i>Ukraine</i>
<i>Costa Rica</i>	<i>Kenya</i>	<i>Paraguay</i>	<i>United Arab Emirates</i>
<i>Cote d'Ivoire</i>	<i>Kiribati</i>	<i>Peru</i>	<i>Uruguay</i>
<i>Croatia</i>	<i>Korea, Rep.</i>	<i>Philippines</i>	<i>Vanuatu</i>
<i>Cyprus</i>	<i>Kuwait</i>	<i>Poland</i>	<i>Venezuela, RB</i>
<i>Czech Republic</i>	<i>Kyrgyz Republic</i>	<i>Qatar</i>	<i>Vietnam</i>
<i>Chad</i>	<i>Lao PDR</i>	<i>Romania</i>	<i>Yemen, Rep.</i>
<i>Chile</i>	<i>Latvia</i>	<i>Russian Federation</i>	<i>Congo, Dem. Rep.</i>
<i>China</i>	<i>Lebanon</i>	<i>Rwanda</i>	<i>Zambia</i>
<i>Djibouti</i>	<i>Lesotho</i>	<i>St. Kitts and Nevis</i>	<i>Zimbabwe</i>
<i>Dominica</i>	<i>Liberia</i>	<i>St. Lucia</i>	
<i>Dominican Republic</i>	<i>Libya</i>	<i>St. Vincent and the Grenadines</i>	

Table A.2 Variable definitions and sources

Variable	Description	Source
Growth rate of GDP per cápita	Annual GDP growth rate minus population growth rate	World Bank, World Development Indicators 2005
Volatility of GDP per cápita growth rate	Standard deviation of GDP per capita growth rate	World Bank, World Development Indicators 2005
Average GDP per cápita 1970-1973	Logarithm of GDP per capita	World Bank, World Development Indicators 2005
Average schoolling years 1970-1975	Logarithm of average schoolling years	World Bank, World Development Indicators 2005
Government consumption	Government consumption over GDP	World Bank, World Development Indicators 2005
Gross capital formation	Gross capital formation over GDP	World Bank, World Development Indicators 2005
Openness	Sum of exports and imports of goods and services as percentage of GDP	World Bank, World Development Indicators 2005
Term of trade growth	Annual growth of terms of trade	World Bank, World Development Indicators 2005
Financial development	Annual difference between quasi-money and money in percentage of GDP	World Bank, World Development Indicators 2005
Volatility of gross capital formation	Standard deviation of gross capital formation over GDP	World Bank, World Development Indicators 2005
Volatility of government consumption	Standard deviation of government consumption over GDP	World Bank, World Development Indicators 2005
Volatility of terms of trade	Standard deviation of terms of trade	World Bank, World Development Indicators 2005
Dummy flexible regime	Dummy variable taking value 1 for countries with flexible exchange rate regime, 0 otherwise	Levy-Yeyati and Sturzenegger (2005)
Dummy intermediate regime	Dummy variable taking value 1 for countries with intermediate exchange rate regime, 0 otherwise	Levy-Yeyati and Sturzenegger (2005)
Regional dummy (Asia)	Dummy variable taking value 1 for Asian countries, 0 otherwise	Own elaboration
Regional dummy (Africa)	Dummy variable taking value 1 for African countries , 0 otherwise	Own elaboration
Regional dummy (Central America)	Dummy variable taking value 1 for Central American countries , 0 otherwise	Own elaboration
Regional dummy (Latin America)	Dummy variable taking value 1 for Latin American countries, 0 otherwise	Own elaboration
Regional dummy (Europe)	Dummy variable taking value 1 for European countries, 0 otherwise	Own elaboration
Regional dummy (small islands)	Dummy variable taking value 1 for small islands, 0 otherwise	Own elaboration